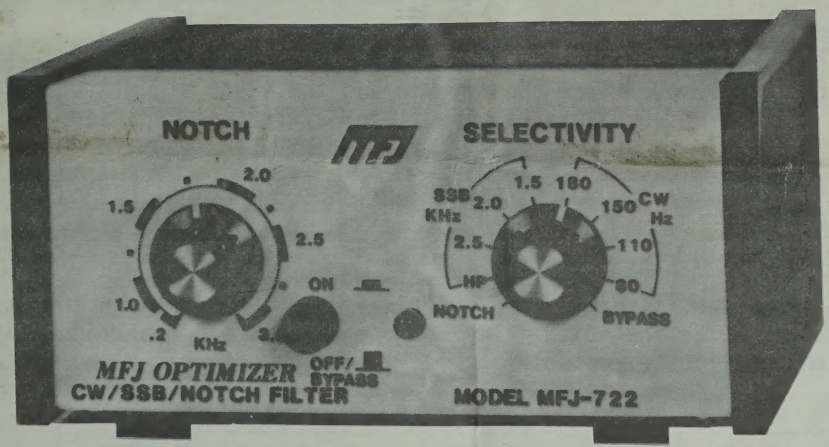
MFJ OPTIMIZER

CW/SSB/NOTCH FILTER

MODEL MFJ-722



OWNER'S MANUAL

CAUTION: Read All Instructions Before Operating Equipment.

MFJ ENTERPRISES, INC.

P. O. BOX 494, MISSISSIPPI STATE, MS. 39762, USA

MFJ 1200-0055-722

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MFJ-722 INSTRUCTIONS

INTRODUCTION

The MFJ-722 OPTIMIZER consists of a tunable notch filter combined with a switch selectable highpass/lowpass filter (SSB) and bandpass (CW) filter. This filtering capability allows you to remove interference from both SSB and CW signals thereby optimizing the desired signal.

INSTALLATION

1. Connect any 9-18 VDC, 300 ma power supply to the POWER jack on the rear of the MFJ-722. An optional AC adapter is available from MFJ Enterprises, Inc. Use a 2.5 mm subminiature plug with the tip positive. An 12 VDC, 300 ma power supply is required for maximum audio power output.
2. Connect a 4 to 16 ohm speaker to the SPEAKER jack or connect a set of mono or stereo headphones to the PHONE jack on the rear of the MFJ-722.
3. Connect a shielded lead, with the proper connector, from the external speaker or headphone jack of your receiver or transceiver to the INPUT jack on the rear of MFJ-722. The INPUT jack accepts an RCA phono plug.

CONTROLS

ON-OFF/BYPASS SWITCH:

When depressed power is applied to the circuit as indicated by the front panel LED. When out power is removed from the circuit and the input signal is switched directly to the SPEAKER and PHONE jacks. The filter circuit is bypassed.

NOTCH:

Varies the frequency of the notch filter section from 300 Hz to 3000 Hz.

SELECTIVITY:

NOTCH- Only the notch filter in the MFJ-722 affects the signal in this switch position. NOTE: The notch filter is operable in all other SELECTIVITY switch positions except BYPASS.

SSB MODE:

HP- The notch filter is followed by a highpass filter which passes all frequencies above 375 Hz. Frequencies below 375 Hz are rejected at the rate of 12 db/octave. This position greatly reduces 60 Hz and 120 Hz and hum and other frequency noise and interference.

2.5- The HP filter is followed by a lowpass filter that rejects frequencies above 2.5 KHz.

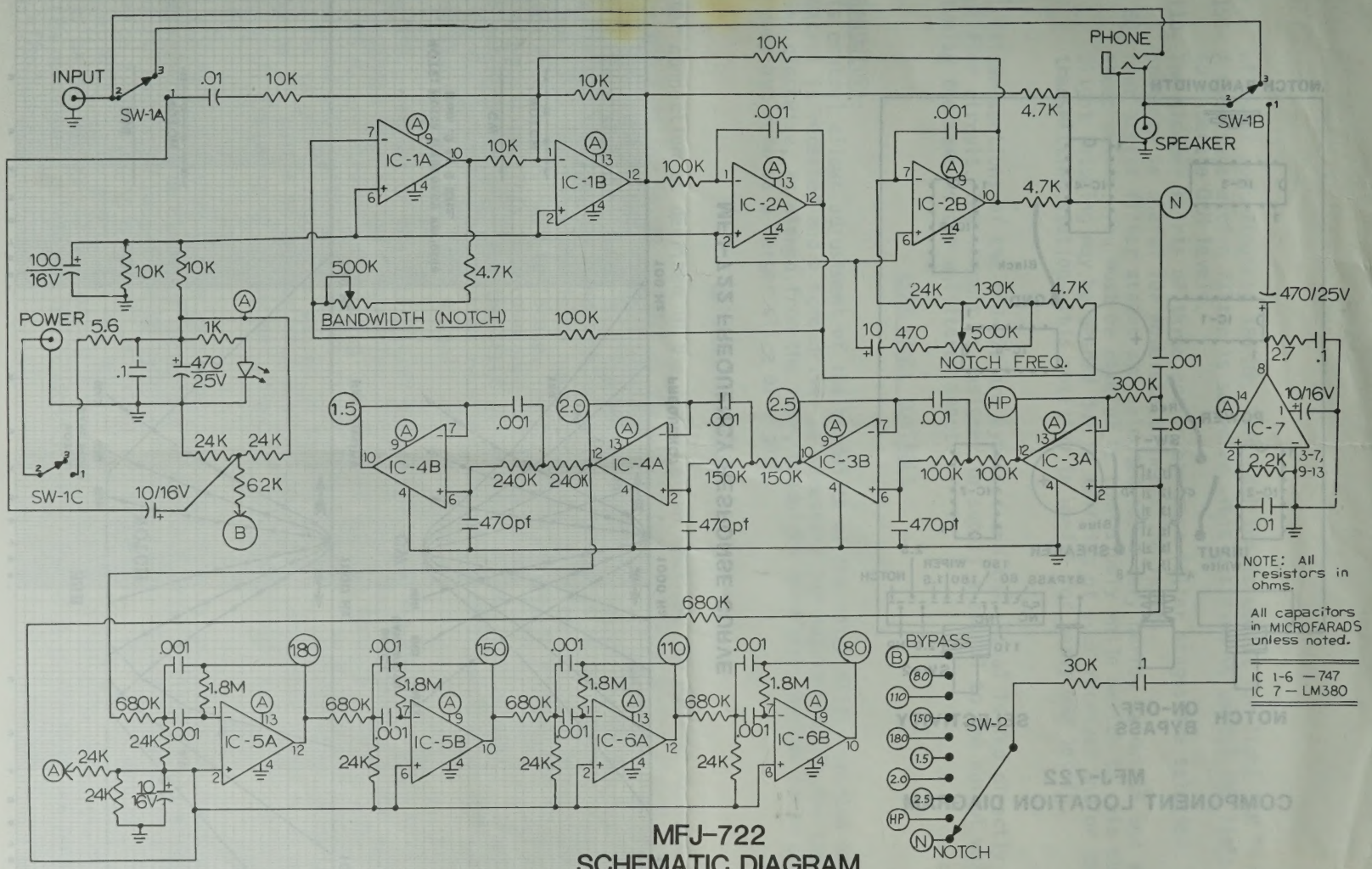
2.0- The 2.5 KHz filter is followed by another lowpass filter to give a cutoff frequency of 2.0 KHz.

1.5- The 2.0 KHz filter is followed by another lowpass filter to give a cutoff frequency of 1.5 KHz.

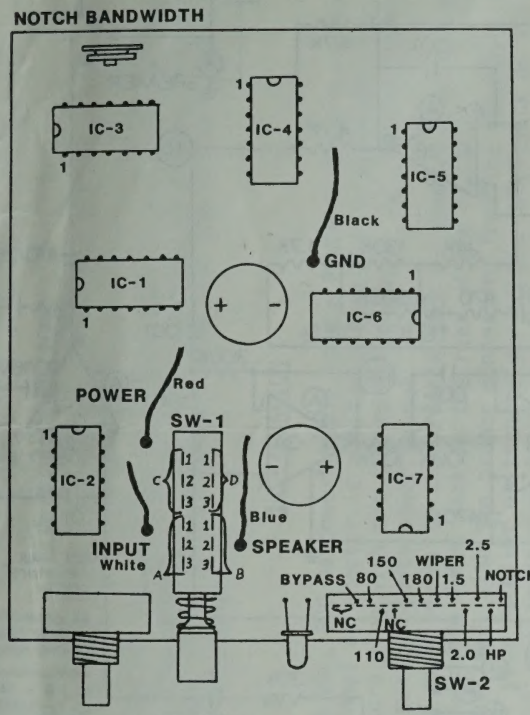
CW MODE:

The center frequency of the CW filters is approximately 750 Hz. The signal level peaks when you tune the signal to this tone. Low Q stages are used for minimum ringing.

180- A single stage, 2 pole active bandpass filter is selected with a 3 db band-

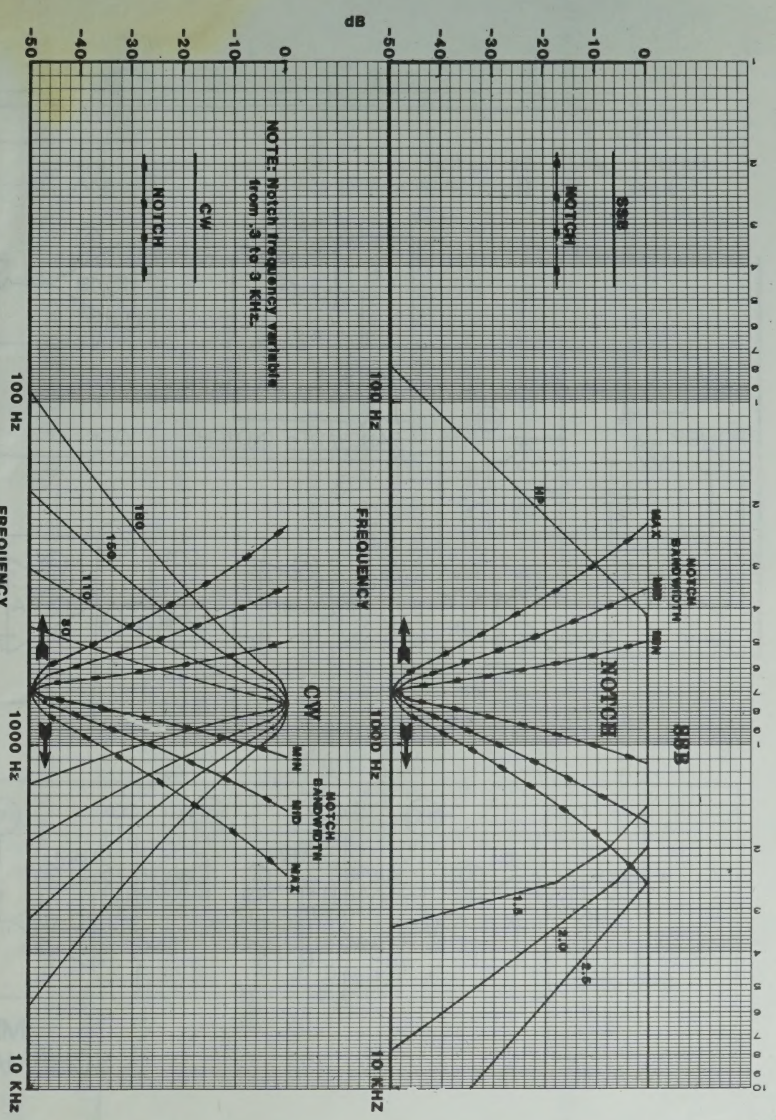


MFJ-722
SCHEMATIC DIAGRAM



MFJ-722
COMPONENT LOCATION DIAGRAM

MFJ-722 FREQUENCY RESPONSE CURVE



width of approximately 180 Hz. This position is useful for light QRM levels.

150- A two-stage active filter is selected. This position is useful for light to moderate QRM levels.

110- The steeper skirts of three active bandpass filter stages are selected. This position is useful for moderate to heavy QRM levels.

80- Four active filter stages are selected for a very narrow bandwidth and very steep skirts. You must be careful to tune slowly while switch to this position. Slight retuning may be needed due to drifting of your receiver and/or the transmitting station. This position is useful for heavy QRM levels.

BYPASS:

All filter sections of the MFJ-722 are bypassed and the signal is fed directly to the amplifier circuit. The circuit is designed to supply a signal to the output which is virtually the same as the unfiltered input.

REAR PANEL CONTROLS

NOTCH BANDWIDTH:

This control allows adjustment of the bandwidth of the notch filter section only. This control is recessed and a screwdriver is necessary for adjustment. As the control is turned clockwise, as viewed from the rear, bandwidth decreases. Narrow bandwidth tuning easy but removes a larger slice of signal.

GENERAL OPERATIONS

After connection as decribed in the INSTALLATION section, the MFJ-722 is ready for use. The notch filter in the MFJ-722 is useful for removing interfering signals near the desired signal such as heterodynes, stations tuning up on your QSO, or CW signals near frequency. Care should be taken that the NOTCH BANDWIDTH control is not set too high or too low. If set too low, the bandwidth is so large the notch filter appears inoperable. If set too high, the bandwidth is so narrow that the NOTCH tuning is very critical and the notch frequency is hard to locate. The BANDWIDTH control is factory set to approximately mid-position. This is recommended until you become familiar with its effect. To use the notch filter only, set the SELECTIVITY switch to the NOTCH position. After tuning in the desired signal on your receiver, adjust the NOTCH control to attenuate unwanted signals near the tuned signal.

The SSB positions of the SELECTIVITY switch optimizes the desired signal by attenuating unwanted high or low frequencies. In the HP position, frequencies below approximately 375 Hz are attenuated reducing interference such as 60 Hz and 120 Hz hum. In the 2.5, 2.0, and 1.5 position, a lowpass filter is activated in addition to the highpass filter. The range of frequencies passed to the speaker or headphones is progressively narrower as the switch is changed from 2.5 to 2.0 to 1.5. Only those frequencies above the HP cutoff frequency of 375 Hz and below the selected lowpass cutoff frequency are passed.

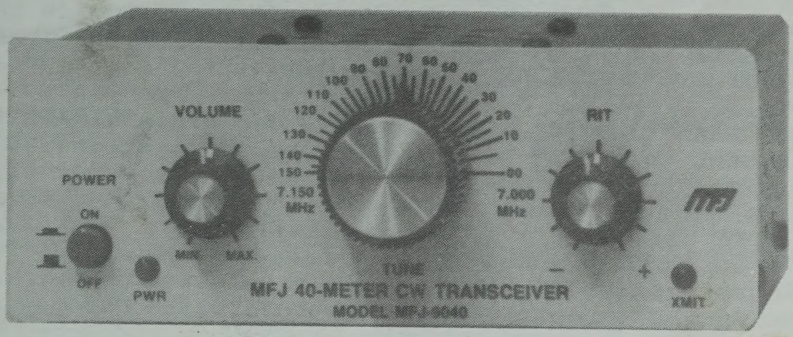
In the CW SELECTIVITY switch positions, bandpass filters of switchable bandwidth are activated. The 3 db bandwidth is as set by the SELECTIVITY switch at either 180 Hz, 150 Hz, 110 Hz, or 80 Hz. At the 80 Hz position the selectivity is so great that you may notice a "talking in a barrel" or slight ringing effect. This is normal for this position. NOTE: 1) Be aware that the notch filter is operable at all SELECTIVITY switch settings except BYPASS. If you do not desire the notch function while using the SSB or CW switch positions, rotate the NOTCH control fully clockwise to minimize the notch filter effect.

FULL 12 MONTHS WARRANTY

MFJ Enterprises, Inc. warrants to the original owner of this product, if manufactured by MFJ Enterprises, Inc. and purchased from an authorized dealer or directly from MFJ Enterprises, Inc. to be free of defects in material and workmanship for a period of 12 months from date of purchase provided the following terms of this warranty are satisfied.

1. The purchaser must retain the dated proof-of-purchase (bill of sale, cancelled check, credit card or money order receipt, etc.) describing the product to establish the validity of warranty claim and must submit the original or a machine-reproduction of such proof-of-purchase to MFJ Enterprises, Inc. at the time of warranty service. MFJ Enterprises, Inc. shall have the discretion to deny warranty without dated proof-of-purchase. Any evidence of alteration, erasure, or forgery of proof-of-purchase shall be cause to void any and all warranty terms immediately.
2. MFJ Enterprises, Inc. agrees to repair or replace at MFJ's option without charge to the original owner any defective product provided the product is returned postage prepaid to MFJ Enterprises, Inc. with a personal check, cashier's check or money order for **$4.00** covering postage and handling.
3. MFJ Enterprises, Inc. will supply replacement parts free of charge for any MFJ product under warranty upon request. A dated proof-of-purchase and a **$4.00** personal check, cashier's check or money order must be provided to cover postage and handling.
4. This warranty is **NOT** void for owners who attempt to repair defective units. Technical consultation is available by calling (601) 323-5869.
5. This warranty does not apply to kits sold or manufactured by MFJ Enterprises, Inc.
6. Wired and tested PC board products are covered by this warranty provided **only the wired and tested PC board is returned.** Wired and tested PC boards installed in the owner's cabinet or connected to switches, jacks, cables, etc. sent to MFJ Enterprises, Inc. will be returned at the owner's expense unrepaired.
7. Under no circumstances is MFJ Enterprises, Inc. liable for consequential damages to person or property by the use of any MFJ product.
8. **Out-of-Warranty Service:** MFJ Enterprises, Inc. will repair any out-of-warranty product provided the unit is delivered prepaid. All charges will be shipped COD to the owner.
9. This warranty is given in lieu of any other warranty express or implied.
10. MFJ Enterprises, Inc. reserves the right to make changes or improvement in design or manufacture without incurring any obligation to install such changes upon any of the products previously manufactured.
11. All MFJ products to be serviced in-warranty or out-of-warranty should be addressed to **MFJ Enterprises, Inc., 921A Louisville Road, Starkville, Mississippi 39759, USA** and must be accompanied by a letter describing the problem in detail along with a copy of your dated proof-of-purchase.
12. This warranty gives you specific rights, and you may also have other rights which vary from state to state.

40 Meter CW Transceiver



MODEL MFJ-9040
INSTRUCTION MANUAL

CAUTION: Read All Instructions Before Operating Equipment

MFJ ENTERPRISES, INC.

P.O. BOX 494, MISSISSIPPI STATE, MS 39762, USA

Rev. 2

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INTRODUCTION:

Congratulations on your choice of the MFJ-9040 40-Meter QRP transceiver. Please read this manual carefully before attempting to operate your new radio. Let's begin with an introduction to some special features we think you'll like!

EASY TO OPERATE: The MFJ-9040 is extremely simple to set up and operate (much easier to use than a complex multi-band digital radio). New Hams will find this feature especially attractive!

GREAT SENSITIVITY: The MFJ-9040 receiver is sensitive -- right down to the noise floor of the band. Plus, we include a four-pole front-end filter, double-balanced mixing, and careful gain distribution to knock down intermod.

EXCELLENT SELECTIVITY: A tight 750-Hz CW-bandwidth crystal filter fights QRM and noise to the max! Add our optional MFJ-726 NARROW AUDIO FILTER for truly QRM-free reception.

SMOOTH AND STABLE VFO: A special wide-spaced reduction drive capacitor glides slowly across the entire CW band (Novice through Extra). Add the convenience of true Receive Incremental Tuning (RIT), and you may forget you aren't operating a "big rig"!

EASY ON THE EARS: You'll appreciate how our graceful AGC tracks signals you want to hear -- and NEVER locks onto strong adjacent signals outside the audio bandpass. In transmit, enjoy crystal-clear 700-Hz sinewave sidetone (no buzzy high-pitched square waves). Stop sending, and the receiver snaps back to life instantly -- at full sensitivity -- thanks to our exclusive "AGC Instant Recovery Circuit" (TM). There's plenty of audio power from the built-in 3" speaker or from your favorite phones.

RUGGED TRANSMITTER: The MFJ-9040 delivers full QRP output, tolerates up to 3:1 VSWR, and easily survives momentary feedline shorts or opens. Our adjustable-hold T/R switching is so fast, you can set it for full QSK during contests! And, 700-Hz offset is automatic; just like on a big rig. For added sending convenience, install the optional MFJ-412 CURTIS IAMBIC KEYER MODULE and hook up your favorite set of paddles.

GO PORTABLE: Take your MFJ-9040 QRP station anywhere with the MFJ-1774 PORTABLE DIPOLE or matching MFJ-971 QRP TUNER. Add a MFJ-4114 RECHARGING NiCd POWER PACK, and head for the hills; the MFJ-9040 can take it! All circuitry is constructed on a rugged double-sided G-10 plate-through pc board and housed in a durable aluminum cabinet (no sheet meatal screws, we use PEM nuts).

You'll find these features add up to hour after hour of operating in arm-chair comfort. Best of all, your radio is backed by MFJ's exclusive unconditional "No Matter What" 1-year guarantee!

TECHNICAL SPECIFICATIONS:

RECEIVER SECTION:

Frequency Coverage:	7.000-7.150 MHz
Receiver Type:	Single conversion superhet
VFO Frequency:	4.85-5.0 MHz
IF Frequency:	12 MHz
IF Selectivity:	750 Hz crystal ladder filter
AGC:	Audio-derived, instant T/R recovery
Sensitivity:	Better than 7.0 MHZ noise floor
RIT:	1.5 KHz range
Audio:	8 Ohms, speaker or external phones
Audio Filter (opt):	700-Hz 4-pole active, unity gain
Receive Current:	50 mA average

TRANSMITTER SECTION:

Keying:	High-Z, semi-QSK
Keyer (opt)	Curtis 8044ABM Iambic
Sidetone:	700-Hz sinewave
RF Power Output:	> 4 W, Vcc 13.8 V, 50-Ohm Load
VSWR Tolerance:	3:1 VSWR or greater
Transmit Current:	1 Amp at 13.8 VDC
T/R Switch:	Semi-QSK, adjustable hold (0-2 sec)

BLOCK DIAGRAM:

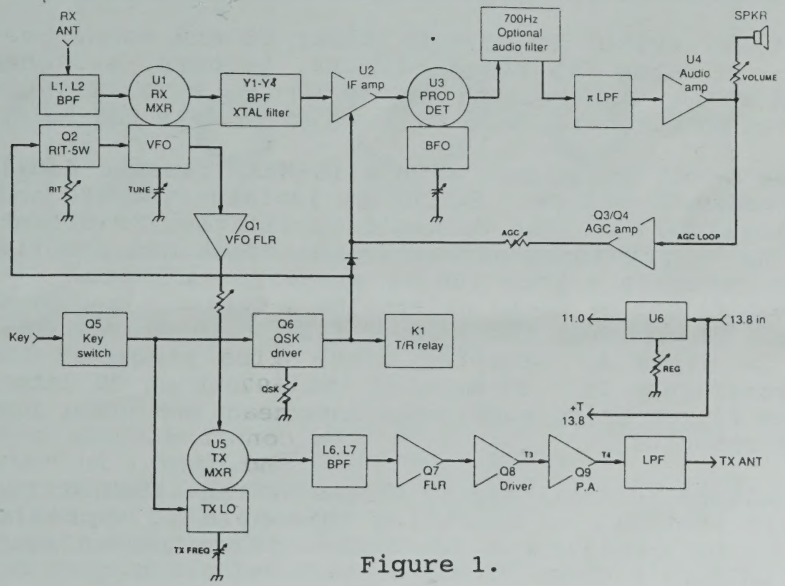


Figure 1.

THEORY OF OPERATION:

If you are technically inclined, read this page for the "inside scoop" on your rig. Please refer to Figure 1.

The MFJ-9040 receiver is a single-conversion superhet design. Received signals are pre-selected by 4-pole bandpass filter at L1-L2, then amplified and converted to 12 MHz by double-balanced mixer U1. The required 5-MHZ VFO signal is generated by U1's internal oscillator. A varactor RIT circuit (switched at Q2) provides VFO shift on receive only. T1 matches the output of mixer U1 into a 750 Hz crystal ladder filter Y1-Y4.

U2 provides 12-MHz IF amplification and gain control. In receive mode, audio-derived AGC maintains constant signal output. During transmit, U2 gain is clamped low -- and the receiver remains on to generate sidetone. The receiver recovers to full gain instantly when clamping voltage is removed.

DBM Product Detector U3 provides audio recovery and gain. A 12-MHZ VXO circuit at U3 generates BFO injection. U3 output passes through a pi-section RC filter to reduce wide-band noise. The optional MFJ-726 NARROW AUDIO FILTER is inserted at this point to provide an extremely narrow audio passband response at 700 HZ.

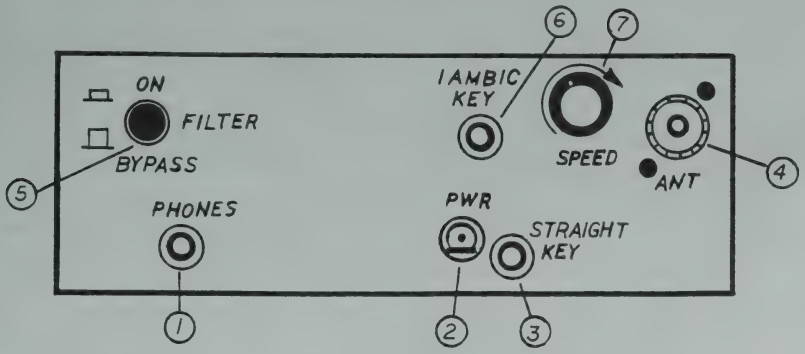
Audio Amplifier U4 drives the AGC and provides output power for speaker or phones. An AGC feedback signal is rectified and amplified through DC amplifiers Q3/Q4 (AGC drive and hang time are set at Q3, and Q4 sets AGC bias for U2). U4 operates at full loop gain, and volume level is set by an adjustable attenuator.

To transmit, DC switch Q5 keys TX Mixer U5 and turns on Relay Driver Q6 -- closing T/R relay K1. K1, in turn, switches the antenna and routes unregulated Vcc to Q7-Q9, a TX LED, Q2, and the AGC clamping circuit. A RC circuit at Q6 sets QSK hold.

U5 mixes the 5-MHZ VFO signal with a 12-MHZ Transmit Oscillator signal to produce 7-MHZ CW. Buffer Q1 isolates the VFO and sets injection level to U5. The Transmit Oscillator VXO offsets the BFO by 700 Hz -- providing automatic CW offset and enabling the receiver to generate a pure 700-Hz sinewave sidetone. A four-pole bandpass filter at L6-L7 attenuates unwanted mixer products, and follower Q7 matches the high-Q filter to driver Q8. Q8, operating in class AB, excites class C PA stage Q9 through matching transformer T3. T4 matches the output of Q9 into a 50-Ohm 1/2-wave filter which suppresses harmonics and other unwanted transmitter products.

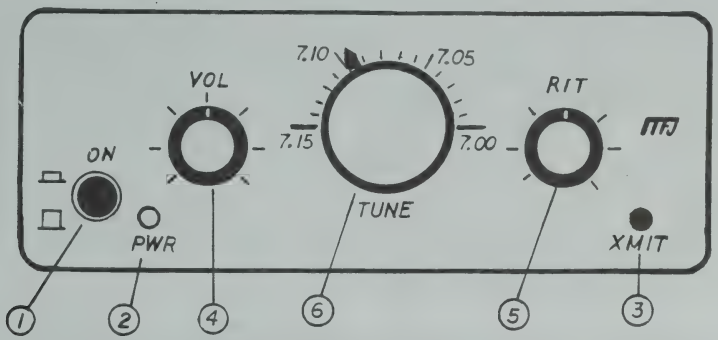
Operating voltage to small-signal stages is regulated at 10.5 VDC by U6. This provides an operating threshold of approximately 11.75 volts to facilitate 12-Volt battery power sources. Individual LM78L05's clamp U1 and U5 at 5 volts Vcc.

MFJ-9040 CONTROL LOCATION AND FUNCTION:



REAR PANEL

1. PHONE JACK: 3.5mm mono jack for low-Z phones or ext. speaker.
2. POWER JACK: 5.5mm OD, 2.1mm ID coaxial, (+) to center pin.
3. KEY JACK: 3.5mm mono jack for handkey (or most keyers).
4. ANTENNA JACK: SO-239 for standard coax plugs.
5. CW FILTER SWITCH: Activates MFJ-726 narrow audio CW filter.
6. IAMBIC KEYER JACK: 3.5mm stereo jack for iambic keyer paddles.
7. KEYER SPEED: Sets sending speed of MFJ-412 Iambic Keyer.



FRONT PANEL

1. POWER SWITCH: Turns power on to the transceiver.
2. "PWR" LED: Indicates when radio turned is on.
3. "XMIT" LED: Indicates when radio is transmitting.
4. VOLUME: Adjusts speaker or headphone volume level.
5. RIT: Shifts receiver frequency.
6. VFO TUNE: Selects transceiver operating frequency.

SETTING UP YOUR MFJ-9040 QRP STATION:

To put the MFJ-9040 on the air, you'll need a power source, a 40-Meter antenna, and a key (headphones optional). Here are some specific suggestions to get you started:

1. POWER SOURCE: 12-15 V @ 1.2 A, (+) TO CENTER PIN

The MFJ-4114 AC/DC POWER PACK is especially designed for your radio. However, you may use any filtered DC power source capable of delivering 12-15 volts at 1.2 Amps (13.8 volts required for full RF output). The power connector at the rear of your MFJ-9040 is a 5.5mm OD, 2.1mm ID coaxial type jack. One 2.1mm plug is provided. Extra plugs are available from local Radio Shack stores under part number 274-1567. Make sure you connect the plus (+) lead to the CENTER PIN of the transceiver power plug.

For portable operation, install NiCds in your MFJ-4114 power pack, or connect any battery capable of providing 12 Volts at 1 Amp directly to the MFJ-9040 power jack. Replace when pronounced key clicks appear on the sidetone (first indication that battery voltage has dropped below the transceiver's voltage regulator threshold).

2. KEY: ACCEPTS MOST TYPES -- USE 3.5mm MONO PLUG

The MFJ-9040 hi-Z keying circuit operates with mechanical keys, relay-output keyers, and most electronic keyers. The "straight-key" jack accepts a standard 3.5mm monaural miniplug. If you wish to plug your paddles directly into the radio, install the optional MFJ-412 CURTIS IAMBIC KEYER MODULE (this accepts a 3.5mm stereo miniplug). You may continue to use a straight-key in normal fashion with the keyer module installed.

3. ANTENNA: VSWR 3:1 OR LESS IN CW BAND

The MFJ-9040 is tolerant of reactive loads, and accepts virtually any 40-Meter antenna with a VSWR of 3:1 or less. To get on the air, hook your regular station antenna to the transceiver's SO-239 connector -- or install a dedicated 40-Meter CW-band dipole such as the MFJ-1774. For non-resonant wire antennas, use a tuner such as the MFJ-971 which features a user-selectable 6-watt SWR range for QRP operation. Avoid operating into unmatched high-SWR antennas. This could result in transmitter instability and the generation of out-of-band spurious signals in violation of FCC rules. For specific antenna suggestions, see "SIMPLE 40-METER ANTENNA SUGGESTIONS" on page 6.

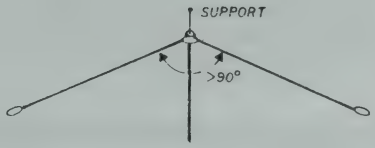
4. HEADPHONES: 8-16 Ohm is Best.

If you use phones, consider purchasing a low-Z monaural set like the Radio Shack #20-210 communications headset.

SIMPLE 40-METER ANTENNA SUGGESTIONS:

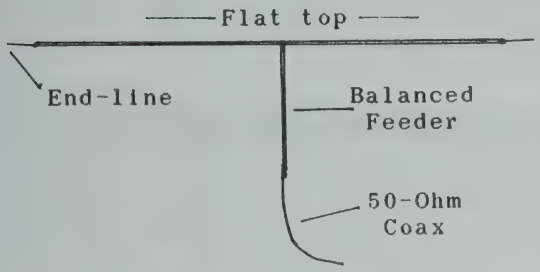
COAXIAL-FED DIPOLES: A wire dipole resonant in the CW portion of the 40-Meter band normally measures 65'6" tip-to-tip (32'9"/leg). Feed with RG-58U or RG-8X. Raise high and in the clear; 30-60 feet is far superior to 10-20. If your yard has support trees, take advantage of their full height. To do this, flip a pull-line over the crown with a spin-casting rig. Attach a permanent nylon support line to the opposite end and reel it back. Avoid climbing on limbs or tall ladders. If you have only one high support, make an inverted V.

DIPOLE

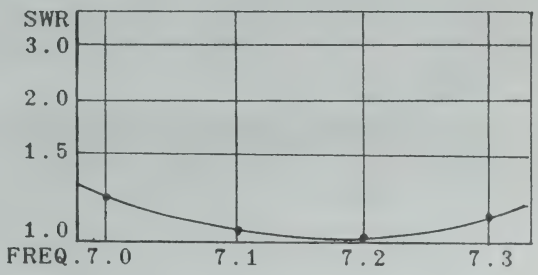


INVERTED V

MFJ-1774 PORTABLE DIPOLE: Consider purchasing a pre-assembled MFJ-1774. This full-size folded dipole type antenna comes complete with 30' of feedline. Antenna and feed are made with light-weight 300-Ohm twinlead, and a special built-in matching network allows you to attach 50-Ohm coax between the MFJ-1774 feed and your rig. When installing the MFJ-1774, avoid running the twinlead portion of your feeder next to metal structures such towers, aluminum siding, or parallel cable runs; detuning may result (coax portion is unaffected). When properly installed, SWR should be low across the entire CW band.



MFJ-1774 DIPOLE



TYPICAL SWR

WARNING: CONSTRUCTING OR ERECTING AMATEUR RADIO ANTENNAS IN LOCATIONS WHERE THEY MAY COME INTO CONTACT WITH ELECTRICAL POWER LINES MAY RESULT IN ACCIDENTAL INJURY OR DEATH. ALWAYS USE CARE!

GETTING THE MOST FROM YOUR QRP STATION:

Spanning the continent -- or even the globe -- with less power than it takes to light a Christmas-tree bulb is not only exciting, it borders on the miraculous. Yet, QRP enthusiasts consistently reach every corner of the planet while sometimes running only microwatts! How do they do it? Here are some tips to help you work some great DX with your MFJ-9040:

Avoid "compromise" antennas whenever possible. An efficient well-matched antenna raised high in the air can very easily make up for the difference between 5 Watts and 50! With a superior antenna, you'll work nearly any station you can hear.

Be a good listener. Searching out and answering CQ's yields many more contacts than repeatedly calling CQ.

When you DO call CQ, try signing "/QRP" at least once so stations will know you are running lower power.

Never hesitate to call a weak station. They may be running low power or using a marginal antenna. You may be loud!

When calling a "rare" DX station, you may have to wait until the big guns make contact and move on before you can get through.

Look before you leap. Wait for a momentary lull in the pile-up, then quickly slip in your call.

Set the VFO slightly up or down frequency and use the RIT control to tune your station in. This way, you'll transmit above or below the pileup -- and increase your chances of being heard.

Let a DX station know you are QRP by signing "/QRP" at the end of your call. If they hear "QRP", they may ask others to stand by.

Pay attention to DX forecasts. When the band is hot, power difference often become much less significant.

OPERATING NOTES FOR NEW NOVICES:

Your MFJ-9040 is much easier to operate than complex digital multi-band transceivers -- and far less expensive to purchase. This makes it the perfect choice for getting started in Amateur Radio. But, despite your radio's "user friendly" characteristics, there's still plenty to learn! Here are some tips to help you get the most from your "first rig".

ASK FOR HELP: Amateurs Radio operators have a long-standing tradition of helping newcomers to the hobby. Take advantage of this resource, and ask another ham to help you set up your first station. Contact a local Radio Club, or simply ask around!

BUILD CODE SPEED: You can use your MFJ-9040 to supplement code tapes with actual "on-air" code experience. To assist CW operators, several organizations regularly broadcast code practice sessions on the 40-Meter band (ARRL's W1AW transmits slow code practice on 7.047 twice daily -- see QST for specific times). Your local Ham Club, Radio Store, or Volunteer License Examiner may know times and frequencies for additional practice stations operating in other regions of the country.

WHEN THE LICENSE ARRIVES: That first contact is an experience you'll remember for life. But, before you jump in and start transmitting, here are some important suggestions:

1. If possible, have a local Ham come over and check your antenna installation for safety and SWR.

2. Adjust the spring-tension and gap adjustments on your key for the best touch. If required, reset you rig's QSK delay control for the most comfortable relay hold-in time (to locate the QSK control, see diagram on page 12).

3. Always set your RIT at 12:00 before you tune in and call your station. Otherwise, you'll call off-frequency.

4. Avoid operating in the margins of your band allocation. As a rule of thumb, stay at least one dial division, or 5 KHZ, from the edge. If you suspect your VFO dial is inaccurate, have it checked against a transceiver with digital readout before you transmit over the air.

NOTE: Your MFJ-9040's VFO is carefully calibrated for accuracy on two occasions before leaving the MFJ factory. MFJ is not responsible for subsequent changes in frequency coverage or dial calibration caused by rough handling or component aging once a radio is in the field. The FCC specifies that all Amateur Radio license holders are ultimately accountable for operating radio transmitters only on assigned frequencies.

OUTDOOR OPERATING:

The MFJ-9040 is rugged, but consider your radio's limitations:

1. The MFJ-9040 cabinet is black, and it absorbs heat. Never operate your radio in direct sunlight.

2. The MFJ-9040 does not have high-SWR shutdown protection circuitry. Consequently, a badly mismatched antenna may cause spurious outputs in violation of FCC rules. To prevent this, you must provide a reasonable antenna -- or use a tuner.

3. When "roughing it", transport your MFJ-9040 in a sealed plastic bag to keep the great outdoors from getting in!

IN CASE OF TROUBLE: CHECK IT OUT FIRST, THEN CALL 800 647-TECH (800 647-8324)

Your MFJ-9040 is backed for one full year by MFJ's exclusive "NO MATTER WHAT GUARANTEE". This means MFJ will repair or replace ANYTHING that goes wrong with your radio for the first year -- no matter what! And, MFJ Customer Service Technicians will be there to help you keep your rig in top shape for as long as you own it. However, before you call the factory with a problem, we ask that you check through this list of common problems first -- just to make sure it isn't something simple you can fix yourself!

1. RADIO WILL NOT POWER UP:
 Check Power Plug -- is it loose? Broken supply wire?
 Check Power Supply -- is supply connected to AC? Turned on?
 Check Battery Voltage -- is battery discharged?

2. NO SIGNALS RECEIVED:
 Check Antenna -- disconnected? Broken or shorted leads?
 Check Propagation -- geomagnetic storm? Dead band?

3. NO AUDIO:
 Check Phone Jack -- is plug inserted defeating the speaker?
 Check Headphones -- broken wire or shorted plug?

4. WON'T TRANSMIT, KEYS ERRATICALLY:
 Check Key Plug or Keyer -- is key making contact? Broken wire?
 Check Power source -- is it powerful enough to operate radio?
 Check QSK Trim-pot -- if delay set too short, radio may not key.

5. KEY CLICKS ON SIDETONE, LOUD SIDETONE:
 Check Power Source -- enough voltage to run radio under load?
 Check Battery Voltage -- time to recharged?

6. ERRATIC OPERATION ON TRANSMIT:
 Check SWR -- is antenna mis-adjusted or damaged?

7. RECEIVER INSENSITIVE OR AGC INEFFECTIVE:
 Check TP-1, set AGC pot for 4.0 V reading (no signal).

8. RECEIVER INSENSITIVE, VOLUME LOW:
 Check TP-2, set REG pot for 10.5 V.

9. EXCESSIVE VFO DRIFT:
 Check Temperature -- is case heating in Sun? Has there been an abrupt temperature change? Is rig on a warm surface?

10. SIDETONE HIGH OR LOW IN FREQUENCY:
 Check TX FREQ trimmer, readjust for a 700-Hz tone in speaker.

If these checks don't uncover the problem, or if you don't feel qualified to make the prescribed adjustments, please call us for help at 800 647-TECH (800 647-8324).

FIELD ALIGNMENT PROCEDURES FOR THE MFJ-9040 TRANSCEIVER:

SPECIAL TOOLS, PARTS, TEST EQUIPMENT:

1. AC Power Supply, MFJ-4114 or 13.8 Volts @ 1.5 Amps
2. Sensitive Voltmeter (DVM or Analog)
3. Non-inductive Alignment Tool kit
4. Frequency Counter
5. QRP Wattmeter with 50-Ohm Resistive Dummy Load
6. 7-MHZ Signal Generator or Weak Signal Source
7. (Optional) General Coverage Receiver -- Digital Readout

INITIAL TEST SET-UP: (see diagram on page 12)

A. Remove transceiver cover.
B. Connect 13.8 Volts Power Supply to Power Jack.
C. Connect Key to Jack.
D. Remove CW Filter and Keyer modules if installed.
E. Install shorting clip on pins 2 and 3 of CW Filter Header.
F. Turn on unit.

VOLTAGE CHECKS AND ADJUSTMENTS: (use voltmeter)

A. VOLTAGE REGULATOR: 10.5 V at TP2, adj. REG trimpot.
B. RECEIVER AGC: 4.0 Volts at TP1, adj AGC trimpot.
C. RIT: Approx 5.3 Volts at TP3 when RIT knob at 12:00.

VFO CALIBRATION: (use frequency counter)

A. Tune VFO dial to 7.100.
B. Transmit into a dummy load.
C. Adjust VFO CAL (L3) for 7.100 readout.

BFO FREQUENCY CHECK AND ALIGNMENT:

A. Connect Voltmeter to TP1 to read AGC voltage.
B. Connect Frequency Counter to speaker output.
C. Apply 7-MHZ signal source to antenna jack (mid-band).
D. Tune in signal for maximum reading at TP1.
E. Adjust Volume for a stable counter reading.

If counter reads approx. 700 Hz, skip BFO alignment and move on.
If not, then:

F. Reset BFO Trimcap until Voltmeter peak coincides with 700 Hz tone.

G. To check suppression of opposite sideband -- tune through zero beat. Little or no signal should be audible on the low side. Radio should be on LSB; tuning up in frequency should cause pitch to go up.

TRANSMITTER OSCILLATOR OFFSET (SIDETONE) ADJUST:

A. Connect dummy load to antenna jack.
B. Connect frequency counter to speaker output.
C. Key transmitter, adjust TX FREQ trimcap for 700 Hz sidetone note.

RECEIVER SENSITIVITY CHECK:

A. Connect 7.1-MHZ signal source to antenna jack.
B. Connect voltmeter to TP1 (AGC voltage)
C. Tune in signal source for maximum AGC indication.
D. Carefully touch up RX1, RX2, IF1, IF2 for max SIG Meter reading.

TRANSMITTER BANDPASS FILTER ALIGNMENT:

A. Connect QRP Wattmeter with dummy load to ANT Jack.
B. Key transmitter, adjust VFO trimpot CCW for 3-W Po.
C. Carefully touch up TX1 and TX2 for peak output.

TRANSMIT MIXER LEVEL:

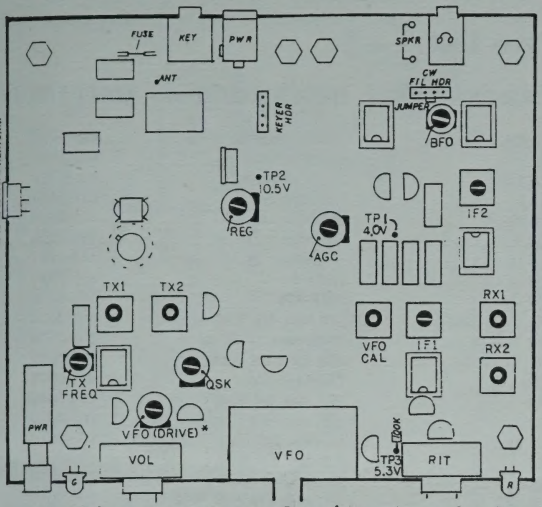
A. Turn VFO Trimpot fully CCW. Key rig.
B. Advance VFO Trimpot CW while watching RF output level. RF output should increase rapidly. Continue CW until further rotation has a visibly reduced effect on output power (indicating mixer gain compression). Stop.
C. Turn VFO trimpot CCW to locate exact point where power starts to drop off rapidly (linear operation).
D. Set VFO Trimpot at TOP of linear region -- the point where further CW movement JUST BEGINS to have reduced effect on RF output power. This point is typically found at about 4.5 Watts output.

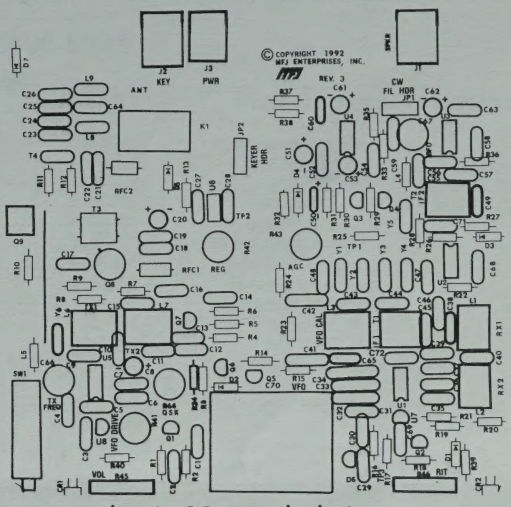
CAUTION: Turning the VFO Trimpot fully CW gives appearance of greater power output. However, much of this energy is spurious energy generated by the overdriven transmitter mixer. Mixer drive must be set as outlined above -- or with the aid of a lab-quality spectrum analyzer -- for the MFJ-9040 transmitter to comply with FCC Standards.

NOTE: The FCC requires HF QRP transmitters to exhibit at least 30 dB suppression of unwanted harmonics and spurious products. A properly adjusted MFJ-9040 will easily exceed this level of suppression.

This completes field alignment of the MFJ-9040 Transceiver. If your transceiver fails to operate properly after following these procedures and adjustments, please call 800 647-TECH (800 647-8324) for help -- or return your unit to the factory for authorized service.

INTERNAL ADJUSTMENT LOCATIONS AND PARTS PLACEMENT, MFJ-9040:





* If reverse-polarity track-fuse opens, install a miniature 1.5-A pigtail fuse or a 3/4" hair-pin loop of #32 wire.

DC VOLTAGE CHART - TROUBLESHOOTING GUIDE:

For advanced troubleshooters, the following are typical DC voltages found in the MFJ-9040 (variation of 0.2 or even 0.3 V is not abnormal in most instances).

Vcc = 13.8 (Supply Voltage) TP-1 = 4.0 (AGC Bias Voltage)
TP-2 = 10.5 (LM-317 Regulated Voltage)
TP-3 = 5.3 (Zero shift RIT Voltage)

INTEGRATED CIRCUITS:

	-------- RX----------				--TX--
Pin	U1	U2	U3	U4	U5
1	1.3	9.4	1.3	1.4	1.3
2	1.3	9.4	1.3	0.0	1.3
3	0.0	0.0	0.0	0.0	0.0
4	3.8	3.1	3.9	0.0	3.8
5	3.8	4.6	3.9	6.8	3.8
6	5.0	3.1	5.1	13.3	5.0
7	4.5	0.0	4.7	6.6	4.9
8	5.0	9.4	5.2	1.4	5.0

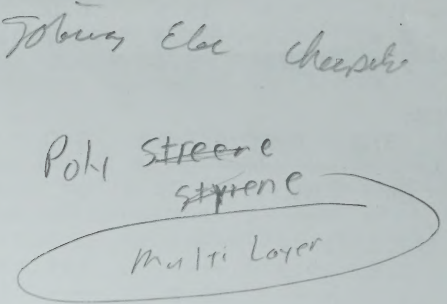
BIPOLAR AND JFET DEVICES:

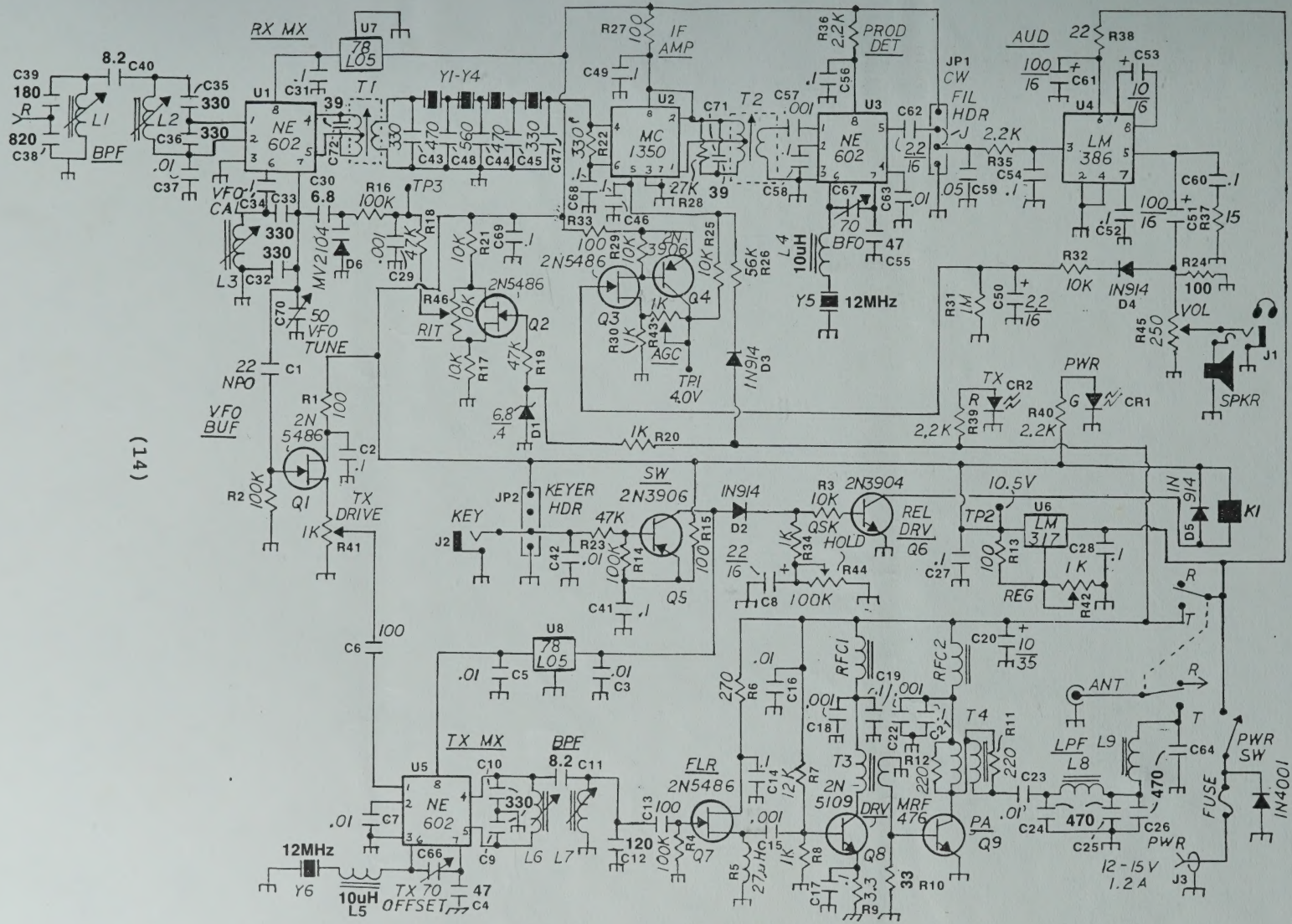
D/E = Drain/Emitter S/B = Source/Base G/C = Gate/Collector

	----------RX----------						------TX-----		
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
D/E	10.2	3.6	9.6	10.1	10.4	----	12.7	.14	----
S/B	1.8	6.8	2.8	9.4	10.3	----	1.9	.8	----
G/C	---	---	---	4.3	----	13.3	----	13.5	13.5

MFJ-9040 Parts List

DESIGNATION	DESCRIPTION	MFJ PARTS #	DESIGNATION	DESCRIPTION	MFJ PARTS #
C1	22pF, 50V Multilayer	205-0022	L1,2,6,7	Yellow Inductor	402-3404
C2,14,17,19,21,27,28,31	.1UF, 50/100V Disc	200-0005	L3	6.5uH Inductor	402-3406
C49,52,56,58,60,68,69	.1UF, 50/100V Disc	200-0005	L4,5	10uH Inductor	401-0102
C3,5,7,16,23,37,41,42	.01uF, 25/50V Disc	200-0004	L8,9	18T Inductor	10-10125
C46,63	.01uF, 25/50V Disc	200-0004	Q1,2,3,7	2N5486	305-6004
C4,55	47pF, 50V Multilayer	205-0021	Q4,5	2N3906	305-0002
C6	100pF, 50V Multilayer	200-0003	Q6	2N3904	305-0001
C8	22uF, 16V Electrolytic	203-0013	Q8	2N5109	305-0017
C9,10,35,36	330pF, 50V Multilayer	205-0330	Q9	MRF-476	305-5476
C11,40	8.2pF, 50V Disc	200-2008	R1,13,15,24,27,33	100 ohm, 1/4 Watt	100-0003
C12	120pF, 1KV Disc	200-2021	R2,4,14,16	100K ohm, 1/4 Watt	100-0029
C13,36,39	100pF, 50V Multilayer	205-0100	R3,17,21,25,29,32	10K ohm, 1/4 Watt	100-0017
C15,18,22,29	0.001uF, 1KV Disc	200-2024	R5	27uH Inductor	401-0078
C20,53	10uF, 35V Electrolytic	203-2023	R6	270 ohm, 1/4 Watt	100-0007
C24,25,26,43,47,64	470pF, 500V Disc	200-1013	R7	12K ohm, 1/4 Watt	100-0051
C30	6.8pF, 50V Multilayer	202-0010	R8,20,30,34	1K ohm, 1/4 Watt	100-0010
C32,33	330pF, 630V Polystyrene	205-2210	R9	3.3 ohm, 1/4 Watt	100-0111
C34	.1UF, 50V Multilayer	205-0560	R10	33 ohm, 1/4 Watt	100-0102
C35	560pF 50V Multilayer	205-0820	R11,12	220 ohm, 1/4 Watt	100-0005
C38	820pF, 50V Multilayer	205-0180	R18,19	47K ohm, 1/4 WAtt	100-0023
C39	180pF, 50V Multilayer	200-1006	R22	330 ohm, 1/4 Watt	100-0074
C43,47	330pF, 50V Multilayer	200-1560	R23	4.7K ohm, 1/4 Watt	100-0014
C44	560pF, 500V Disc	205-0470	R26	56K ohm, 1/4 WAtt	100-0052
C45,48	470pF, 50V Multilayer	203-8022	R28	27K ohm, 1/4 Watt	100-0021
C50	2.2uF, 16V Tan.	203-0003	R31	1M ohm, 1/4 Watt	100-0040
C51,61	100uF, 16V Electrolytic	200-0031	R35,36,39,40	2.2K ohm, 1/4 Watt	100-0012
C54,59	.047uF, 50V Disc	205-1010	R37	15 ohm, 1/4 Watt	100-0075
C62	0.001uF, 50V Multilayer	203-0002	R38	22 ohm, 1/4 Watt	100-0112
C65	2.2uF, 35V Electrolytic	205-0010	R41,42,43	1K ohm, Trimpot	104-4001
C66,67	10pF, 50V Multilayer	204-0010	R44	100K ohm, Trimpot	104-4004
C70	12-100pF, 250V Trimmer	204-5050	R45	250 ohm, Pot	105-0007
C71,72	5-50pF, 750V Tuning Cap	205-0039	R46	10K ohm, Pot	105-0002
CR1	MV5753 Red LED	320-0001	RFC1	4T Inductor	10-10121
CR2	Green LED	320-0002	SW1	Switch	504-0022
D1	1N5235B	301-5235	T1,2	25K:1K Inductor	402-3123
D2,3,4,5	1N4148	300-0003	T3	5:1 Transformer	10-10094
D6	MV2104	315-2104	T4	10T Toroid	10-10045
D7	1N4001	300-1004	U1,3,5	NE602	311-1602
J1	3.5mm Stereo	601-5003	U2	MC1350P	311-1045
J2	3.5mm Mono	601-5002	U4	LM386	311-0386
J3	2.1mm Coaxial	601-6021	U6	LM317T	307-1021
JP1,2	4 Pin Header	612-0014	U7,8	78L05AC	307-0010
K1	12V Relay	408-2035	Y1,2,3,4,5,6	10MHz Crystal	405-0065





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SCHEMATIC DIAGRAM, MFJ-9040

FULL 12 MONTHS WARRANTY

MFJ Enterprises, Inc. warrants to the original owner of this product, if manufactured by MFJ Enterprises, Inc. and purchased from an authorized dealer or directly from MFJ Enterprises, Inc. to be free of defects in material and workmanship for a period of 12 months from date of purchase provided the following terms of this warranty are satisfied.

1. The purchaser must retain the dated proof-of-purchase (bill of sale, cancelled check, credit card or money order receipt, etc.) describing the product to establish the validity of warranty claim and must submit the original or a machine-reproduction of such proof-of-purchase to MFJ Enterprises, Inc. at the time of warranty service. MFJ Enterprises, Inc. shall have the discretion to deny warranty without dated proof-of-purchase. Any evidence of alteration, erasure, or forgery of proof-of-purchase shall be cause to void any and all warranty terms immediately.
2. MFJ Enterprises, Inc. agrees to repair or replace at MFJ's option without charge to the original owner any defective product provided the product is returned postage prepaid to MFJ Enterprises, Inc. with a personal check, cashier's check or money order for **$4.00** covering postage and handling.
3. MFJ Enterprises, Inc. will supply replacement parts free of charge for any MFJ product under warranty upon request. A dated proof-of-purchase and a **$4.00** personal check, cashier's check or money order must be provided to cover postage and handling.
4. This warranty is **NOT** void for owners who attempt to repair defective units. Technical consultation is available by calling (601) 323-5869.
5. This warranty does not apply to kits sold or manufactured by MFJ Enterprises, Inc.
6. Wired and tested PC board products are covered by this warranty provided **only the wired and tested PC board is returned.** Wired and tested PC boards installed in the owner's cabinet or connected to switches, jacks, cables, etc. sent to MFJ Enterprises, Inc. will be returned at the owner's expense unrepaired.
7. Under no circumstances is MFJ Enterprises, Inc. liable for consequential damages to person or property by the use of any MFJ product.
8. **Out-of-Warranty Service:** MFJ Enterprises, Inc. will repair any out-of-warranty product provided the unit is delivered prepaid. All charges will be shipped COD to the owner.
9. This warranty is given in lieu of any other warranty express or implied.
10. MFJ Enterprises, Inc. reserves the right to make changes or improvement in design or manufacture without incurring any obligation to install such changes upon any of the products previously manufactured.
11. All MFJ products to be serviced in-warranty or out-of-warranty should be addressed to **MFJ Enterprises, Inc., 921A Louisville Road, Starkville, Mississippi 39759, USA** and must be accompanied by a letter describing the problem in detail along with a copy of your dated proof-of-purchase.
12. This warranty gives you specific rights, and you may also have other rights which vary from state to state.